CUSP Las Vegas Annual Meeting - Colorado Update

Yanrui (Daisy) Ning, Ali Tura Jun 2nd, 2022











Overview of Colorado sources and sequestration options



Denver-Julesburg (DJ) Basin

Stacked formation



Stratigraphic column







CCUS Total Costs of Different Sources













Economics of CCUS analysis of different Sources: Cost + 2026 Credits + Revenues



b) Economics of CO₂ - Saline Aquifer Storage CCUS(\$US/tCO2):



The Average scenarios show that

<u>CO₂ via EOR</u> is more profitable than <u>CO2 storage in saline aquifers</u>



Reservoir Simulation Model Based on One Section

11 horizontal wells

2 injection cycles are tested. Each lasts 2 years:

• 6-month injection, 6-month shut-in, 12-month production

Injection composition: 90% CO₂, 10% CH₄



2-year Primary Production + 4-year EOR Period

Higher injection rates, more injectors

higher amount of enhanced oil and CO₂ storage





Cumulative Oil production

(Primary production: Year 0 - 2; 2 Huff-n-Puff cycles : Year 2 - 6)





Colorado Springs Utilities





Can CO₂-EOR Reduce Overall CO₂ Emission?

Scenario 11

• 4 injectors, 5-yr primary production, 4 MMscf/day injection rate

Enhanced oil (thousand bbl)	127	Stored CO ₂ (ton)	49
Conversion factor: 1 bbl oil = 0.51 ton CO ₂ (how much CO2 is emitted by combustion of a bbl of oil)			
EOR oil equivalent CO ₂ (thousand ton)	65		
Stored CO ₂ /enhanced oil equivalent CO ₂	0.76		
(Heidug et al. 2015)			

Carbon Neutral oil: ratio = 1 (carbon stored = carbon produced) Carbon Negative oil: ratio > 1 (more carbon stored than produced)











Potential Leakage Pathways



NRAP-IAM

Assumption:

leakage occurs in the annulus between the outside of the casing & borehole









CO₂ May Leak Through the Wellbore of Well A













One-square-mile Layer-cake Model

Properties

- Pierre sandstone: 2000 ft thickness, porosity = 14%, perm = 0.1 mD
- Well permeability along seal formation: 5 mD
 > an example value, will be updated based on specific well design

Injection

• 30-year CO₂ injection (1MMton/year) + 100-year post-injection





CO₂ Leakage to the Drinking Water Formation



- total CO₂ leakage: 0.23 tons
- total CO₂ injection: 30 MM tons
- ratio: 7.7e-9



Acknowledgement

- US Department of Energy (#DE-FE0031837)
- Carbon Utilization and Storage Project (CUSP)
- Los Alamos National Lab









